1. PAGE TITLE: Approval Authority		2. REPLACES	3. SECTION: 1010
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. AUTHORITY (REFERENCES) 10 REMARKS:	

PROJECT CENTER(S)		LEAD CENTER	
11. PREPARED BY: Angelita C. Kelly, Code 505 EOS Mission Operations Manager (MOM) Earth Science Data and Information System Project	DATE	15. CODE 500 RESPONSE PREPARED BY: John P. Lynch, Code 553 Flight Dynamics Engineer	DATE
12. APPROVED BY: Mark Fontaine, Code 170 Deputy Director/Resources Mission To Planet Earth		16. CODE 500/APPROVED BY: Arthur J. Fuchs Director of Mission Operations and Data Systems	
13. APPROVED BY: L. E. Mauldin, III SAGE III Project Manger		17. CODE 800 RESPONSE PREPARED BY: Alan R. Selser, Code 822.3 Head, RF Tracking and Digital Systems Section	
14. APPROVED BY: Dr. M. Patrick McCormick SAGE III Principal Investigator		18. CODE 800 / APPROVED BY: Arnold L. Torres Director of Suborbital Project and Operations	

1. PAGE TITLE: Revision Approval		2. REPLACES	3. SECTION: 1030
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. AUTHORITY (REFERENCES) 10 REMARKS:	

PROJECT CENTER(S)		LEAD CENTER	
11. PREPARED BY: Angelita C. Kelly, Code 505 EOS Mission Operations Manager (MOM) Earth Science Data and Information System Project	DATE	15. CODE 500 RESPONSE PREPARED BY: John P. Lynch, Code 553 Flight Dynamics Engineer	DATE
12. APPROVED BY: Mark Fontaine, Code 170 Deputy Director/Resources Mission To Planet Earth		16. CODE 500/APPROVED BY: Arthur J. Fuchs Director of Mission Operations and Data Systems	
13. APPROVED BY: L. E. Mauldin, III SAGE III Project Manger		17. CODE 800 RESPONSE PREPARED BY: Alan R. Selser, Code 822.3 Head, RF Tracking and Digital Systems Section	
14. APPROVED BY: Dr. M. Patrick McCormick SAGE III Principal Investigator		18. CODE 800 / APPROVED BY: Arnold L. Torres Director of Suborbital Project and Operations	

1. PAGE TITLE: Revision Control		2. REPLACES	3. SECTION: 1031
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

Revision	Page No.	Ch. No.	Revision	Page No.	Ch. No.	Revision	Page No.	Ch. No.

1. PAGE TITLE: Change Page Approval		2. REPLACES	3. SECTION: 1032
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. AUTHORITY (REFERENCES) 10 REMARKS:	

PROJECT CENTER(S)		LEAD CENTER	
11. PREPARED BY: Angelita C. Kelly, Code 505 EOS Mission Operations Manager (MOM) Earth Science Data and Information System Project	DATE	15. CODE 500 RESPONSE PREPARED BY: John P. Lynch, Code 553 Flight Dynamics Engineer	DATE
12. APPROVED BY: Mark Fontaine, Code 170 Deputy Director/Resources Mission To Planet Earth		16. CODE 500/APPROVED BY: Arthur J. Fuchs Director of Mission Operations and Data Systems	
13. APPROVED BY: L. E. Mauldin, III SAGE III Project Manger		17. CODE 800 RESPONSE PREPARED BY: Alan R. Selser, Code 822.3 Head, RF Tracking and Digital Systems Section	
14. APPROVED BY: Dr. M. Patrick McCormick SAGE III Principal Investigator		18. CODE 800 / APPROVED BY: Arnold L. Torres Director of Suborbital Project and Operations	

1. PAGE TITLE: Change Page Control		2. REPLACES	3. SECTION: 1033
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

Revision	Page No.	Ch. No.	Revision	Page No.	Ch. No.	Revision	Page No.	Ch. No.

1. PAGE TITLE: Contents and Document Outline		2. REPLACES	3. SECTION: 1040
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Page No.	10. Used	11. Title
1000		Information
1010	X	Approval Authority
1030	X	Revision Authority
1031	X	Revision Control
1032	X	Change Approval
1033	X	Change Control
1040	X	Contents and Document Outline
1061	X	Special Abbreviations and Nomenclature
1064	X	Responsibilities for Management, Project and Operations
1065	X	Technical References
1066		Compliance to Aerospace Data System Standards and Other Applicable Documents
1100		Project Description
1110		Experiments Description
1130		Operations Concept
1140		Planned Mission Milestones
1310		Launch Vehicle Description - General
1311		Launch Vehicle Characteristics
1312		Launch Vehicle Drawing
1320		Spacecraft/Payload Description
1322		Spacecraft/Payload Drawing
1405		Frequency Utilization Summary
1410		Launch Vehicle Metric Tracking Systems - Operating Description
1411		Launch Vehicle Metric Tracking Systems - Transponder/Beacon Telecommunications System Parameters
1420		Spacecraft/Payload Telemetry Systems Description
1421		Spacecraft/Payload Telecommunications System Parameters - Telemetry
1430		Spacecraft/Payload Command Systems Description
1431		Spacecraft/Payload Telecommunications System Parameters - Command
1710		Launch Vehicle Major Mission Events
1711		Launch Vehicle Flight Sequence - Mark Events
1715		Spacecraft/Payload Major Mission Events
1720		Launch Vehicle Trajectory Data
1725		Spacecraft/Payload Orbital Parameters
2000	X	Radio Frequency (RF) Telecommunications Requirements
2005	X	RF Telecommunications - Summary Tables
2020	X	RF Telecommunications - Telemetry Frame Structure
2030		RF Telecommunications - Command Word Structure
2100		Space Network (SN) Requirements - Summary
2110		SN - Tracking Requirements
2120		SN - Return Link Requirements
2130		SN - Forward Link Requirements
2200		Deep Space Network (DSN) Requirements - Summary
2210		DSN - Radiometric Requirements
2215		DSN - Radio Science Requirements
2220		DSN - Downlink Requirements

1. PAGE TITLE: Contents and Document Outline			2. REPLACES	3. SECTION: 1040
			DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE		6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Page No.	10. Used	11. Title
2230		DSN - Uplink Requirements
2240		DSN - Multimission Navigation Requirements
2250		DSN - Monitor and Control Requirements
2300		Ground Network (GN) Summary
2310		GN Metric Tracking Requirements
2320		GN - Downlink Requirements
2330		GN - Uplink Requirements
2400	X	Wallops Flight Facility (WFF) Requirements - Summary
2410		WFF - Metric Tracking Requirements
2420	X	WFF - Downlink Requirements
2430		WFF - Uplink Requirements
2500		Interagency Requirements - Summary
2510		Interagency Metric Tracking Requirements
2520		Interagency Downlink Requirements
2530		Interagency Uplink Requirements
2600		International Networks Requirements - Summary
2610		International Networks -Metric Tracking
2615		International Networks - Radio Science Requirements
2620		International Networks - Downlink Requirements
2630		International Networks - Uplink Requirements
2700		Additional RF Telecommunications Requirements
3000	X	Testing and Training Requirements
3100	X	Compatibility Testing
3200		Networks Readiness Testing
3300		Mission Readiness Testing
3400		Simulators and Test Tools
3500		Training
4000		Mission Operations Center Requirements - Summary
4100		Mission Operations Systems Requirements
4200		Flight Software Maintenance Requirements
4300		Facilities Requirements
4400		Mission Operations Support Requirements
5000		Ground Communications and Data Transport Requirements - Summary
5100		Ground-to-Ground Data Transport Requirements
5200		Additional Ground Communications
6000		Data Processing Requirements - Summary
6100		Data Processing Requirements - Real-time
6200		Data Processing Requirements - Non-Real-time
6300		Data Processing Requirements - Data Archive/Storage
6400		Data Processing Requirements - Additional
7000	X	Trajectory and Attitude Support Requirements - Summary
7100		Attitude Determination and Control Requirements
7200	X	Trajectory Requirements
7300		Attached Payload Requirements
Appendix A	X	Mission Requirements Request

1. PAGE TITLE: Special Abbreviations and Nomenclature		2. REPLACES	3. SECTION: 1061
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

Term	Definition
CCSDS	Consultative Committee for Space Data Systems
DAAC	Distributed Active Archive Center
DSN	Deep Space Network
DSM	Data Systems Manager
EBnet	EOSDIS Backbone Network
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
ETU	Engineering Test Unit
ESDIS	Earth Science Data and Information System
FDD	Flight Dynamics Division
FOO	Flight of Opportunity
FTP	File Transfer Protocol
GLONASS	Russian equivalent of the GPS
GN	Ground Network
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
HP	Hewlett Packard
ICD	Interface Control Document
ISS	International Space Station
kb	Kilobits
kbps	Kilobits per second
LaRC	Langley Research Center
MHz	Megahertz
MOM	Mission Operations Manager
MOU	Memorandum of Understanding
MSM	Mission Support Manager
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NIIEM	Russian Institute for Electric Mechanics
PM	Phase Modulation
RF	Radio Frequency
RSA	Russian Space Agency
SAGE	Stratospheric Aerosol and Gas Experiment
SAGE III	Stratospheric Aerosol and Gas Experiment III
SAM	Stratospheric Aerosol Measurement
SAM II	Stratospheric Aerosol Measurement II
SCF	Science Computing Facility
SN	Space Network
TBD	To Be Determined
WFF	Wallops Flight Facility

1. PAGE TITLE: Responsibilities for Management, Implementation Operations and Services		2. REPLACES	3. SECTION: 1064
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Organization/Title	10. Responsibilities
Program Office	GSFC Mission To Planet Earth Office / Code 170
Project Center	Langley Research Center Project Manger - L. E. Mauldin III Principal Investigator - Dr. M. Patrick McCormick
Ground System Manager	N/A
Mission Manager	N/A
Co-Project Center	GSFC
SAGE III Mission Operations Manager	Mike Cisewski
Launch Vehicle Manager	N/A
Lead Center	GSFC
DSM, MSM, Tracking and Data System Manager	N/A
System Manager	N/A
Network Director	N/A
Science Data Processing Lead	GSFC ESDIS Project / Code 505
Program Manager	Mark Fontaine

1. PAGE TITLE: Technical References		2. REPLACES	3. SECTION: 1065
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

a. SAGE III Working Agreement Between GSFC/Mission to Planet Earth Office and the LaRC/SAGE III Principal Investigator and the LaRC/SAGE III Project Office (Draft), March 1996

b. Earth Science and Data and Information System (ESDIS) Project Level 2 Requirements, Volume 6, Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Requirements, September 1995

c. SAGE III Mission Operations Concept Document, LaRC 475-01-01, March 1996

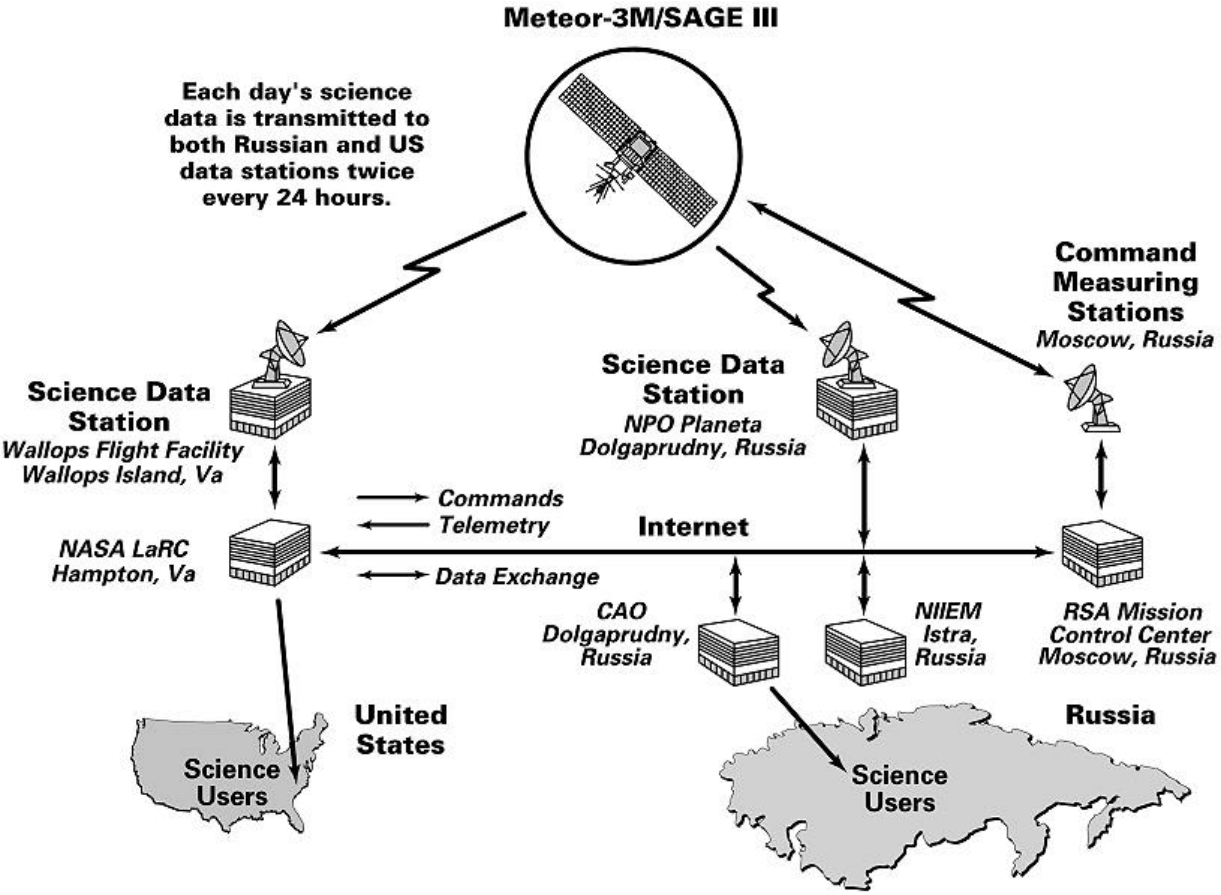
1. PAGE TITLE: Project Description		2. REPLACES	3. SECTION: 1100
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

GENERAL DESCRIPTION

SAGE III is an Earth limb-scanning grating spectrometer which obtains profiles of aerosols, trace gases, clouds, temperature and pressure in the mesosphere, stratosphere, and troposphere with 1 to 2 kilometer vertical resolution. The SAGE III duty cycle runs during solar and lunar occultation, approximately 3 times per orbit for 8 minutes per observation. The instrument has a 100 kbps data rate during its duty cycle, yielding an average daily data rate of about 24 kbps.

The SAGE III instrument will be flown on-board the Russian Meteor-3M spacecraft. The Meteor-3M spacecraft is placed into a circular sun synchronous orbit of 1020 kilometers altitude at a 99.64 degree inclination aboard a Russian Zenit-2 Launch Vehicle. The ascending node crossing time is 9:15 AM, ± 15 minutes local mean solar time (LMST).



* Command Measuring Stations include other unlisted ground sites, as well as Moscow.

METEOR-3M/SAGE III Telemetry and Command Flow

1. PAGE TITLE: Experiment Description		2. REPLACES	3. SECTION: 1110
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

SAGE III is an improved extension of the successful Stratospheric Aerosol Measurement II (SAM II), SAGE I, and SAGE II experiments. The additional wavelengths and lunar occultation that SAGE III provides will improve aerosol characterization; improve the gaseous retrievals of O_3, H_20, and NO_2; add retrievals of NO_3 and OClO; and extend the vertical range of measurements.

The scientific goals of the Meteor-3M/SAGE III Project are:

- Retrieve global profiles (1 to 2 kilometer vertical resolution) of atmospheric aerosols, ozone, water vapor, NO_2, NO_3, OClO, temperature, and pressure in the mesosphere, stratosphere, and troposphere.

- Investigate spatial and temporal variability of the measured species in order to determine their role in climatological processes, biogeochemical cycles, the hydrologic cycle, and atmospheric chemistry.

- Characterize tropospheric and stratospheric aerosols and upper tropospheric and stratospheric clouds and investigate their effects on the Earth's environment, including radiative, microphysical, and chemical interactions.

- Extend the SAM II, SAGE I and SAGE II self-calibrating solar occultation data sets (begun in 1978), enabling the detection of long-term trends.

- Provide atmospheric data essential for the calibration and interpretation/correction of other satellite sensors, including EOS and ground-based sensors.

1. PAGE TITLE: Mission Operations Concept		2. REPLACES	3. SECTION: 1130
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

The purpose of this section is to provide basic, high level, information describing the SAGE III mission operations concept for the Meteor 3M mission. The following paragraphs will describe forward link (command), return link (data reception), flight operations, and mission support activities.

Forward Link

The Russian Space Agency (RSA) Meteor 3M control center, located in Kaliningrad, Russia, will be responsible for transmitting commands to the spacecraft and instrument. The Kaliningrad control center is capable of routing commands to a number of command transmission stations located throughout Russia. During routine operations, commands are transmitted to the spacecraft and SAGE III instrument once every two (2) weeks. However, additional command support is available to make SAGE III operational adjustments and flight software modifications, as required.

The NASA SAGE III operations center at LaRC will develop command loads necessary to operate the instrument and transfer the load information to the RSA Meteor 3M control center via the Internet or other electronic medium. Operational timelines, command formats, and detailed operations plans will be documented in a jointly developed Meteor 3M/SAGE III Mission Operations Plan. Meteor 3/TOMS mission operations will continue to be used as the "blueprint" for Meteor 3M/SAGE III operations planning.

Return Link

The return link for the Meteor 3M mission is similar to the scheme used during the Meteor 3/ TOMS mission. For the Meteor 3M / SAGE III mission, identical sets of instrument data will be relayed two times daily to ground stations located in Dolgoprudny, Russia and Wallops Island, Virginia. The GSFC Wallops Flight Facility (WFF) is responsible for data reception, archival of raw data for at least two weeks, data quality monitoring, and supporting data transfer to LaRC.

Upon receipt at WFF, the raw SAGE data will be automatically transferred to the SAGE III operations center for Level 0 processing. Level 0 data will be distributed to the SAGE III Scientific Computing Facility (SCF) and to the EOSDIS LaRC DAAC. Level 0 data will be automatically checked at the SAGE III operations center to verify that instrument health, safety, and performance parameters are within established operating limits and performance metrics.

SAGE III housekeeping data will be monitored by ground controllers at the RSA Meteor 3M control center in Kaliningrad, Russia. Ground controllers will execute SAGE III provided contingency procedures in the event of a malfunction or limit violation and notify SAGE III LaRC operations personnel. The feasibility of transmitting SAGE housekeeping data in real time to the SAGE III operations center at LaRC via the Internet is being explored.

Flight Operations

SAGE III flight operations will consist of planning, execution, and analysis activities.

Planning Activities

The basic operational plan for SAGE III operations is to obtain solar occultation data and lunar occultation data whenever the viewing geometry permits and instrument health and safety is not compromised. The SAGE III flight software design should provide for near autonomous instrument operations. The basic software requirement is "A set of command algorithms shall be developed and installed within the flight software capable of performing routine on-orbit operations without human intervention. The algorithms developed may require initialization data and should assume that accurate time and spacecraft position data are available from the host platform".

During the operational phase of the Meteor 3M/SAGE III mission, solar occultation data will be obtained every spacecraft sunset event and spacecraft sunrise event. Lunar occultation data will be obtained whenever the solar zenith angle for the tangent location is greater than 95 degrees and the phase of the moon is between 90 degrees and 270 degrees (0 degrees = new moon, 180 degrees = full moon).

Detailed instrument operation planning will begin roughly one month prior to the operational day. Host platform ephemeris and planning data will be used to predict potential solar/lunar events and identify periods where constraints may limit operations. Based on this data, the SAGE III operations center will prepare an operational plan (command load) necessary to safely carry out the science objectives. Where constraints or resources limit operations, the operations center, with science input, will negotiate with the RSA Meteor 3M control center to resolve conflicts.

Approval and execution of the operational plan will be carried out based on negotiated operational timelines. During routine operations, commands will be transmitted to SAGE III once every two weeks.

Execution Activities

During the execution phase, or operational day, the SAGE III operations center will verify that the instrument is performing as planned; verify instrument health, safety, and performance; and ensure that Level 0 data products are transferred to the LaRC DAAC and SAGE III SCF.

Analysis Activities

A number of analysis activities will be carried out. First, a great deal of interaction with SAGE scientists and software developers is anticipated to verify that the instrument configuration is yielding the best possible science and that instrument effects on the data are understood. Second, trend analyses will be carried out on a monthly schedule to verify that instrument performance has not changed. If performance changes are noted, plans will be developed and implemented to extend instrument life and/or maximize science.

Mission Support Activities

A number of mission support activities, not previously mentioned, are essential for successful SAGE III operations. Reliable communications is one activity. The ESDIS Project will provide link operations and data transfer communications links between LaRC and WFF for the Meteor 3M mission. Definition, development support, maintenance and testing of communications links between the U.S. and Russia will be conducted by the ESDIS Project.

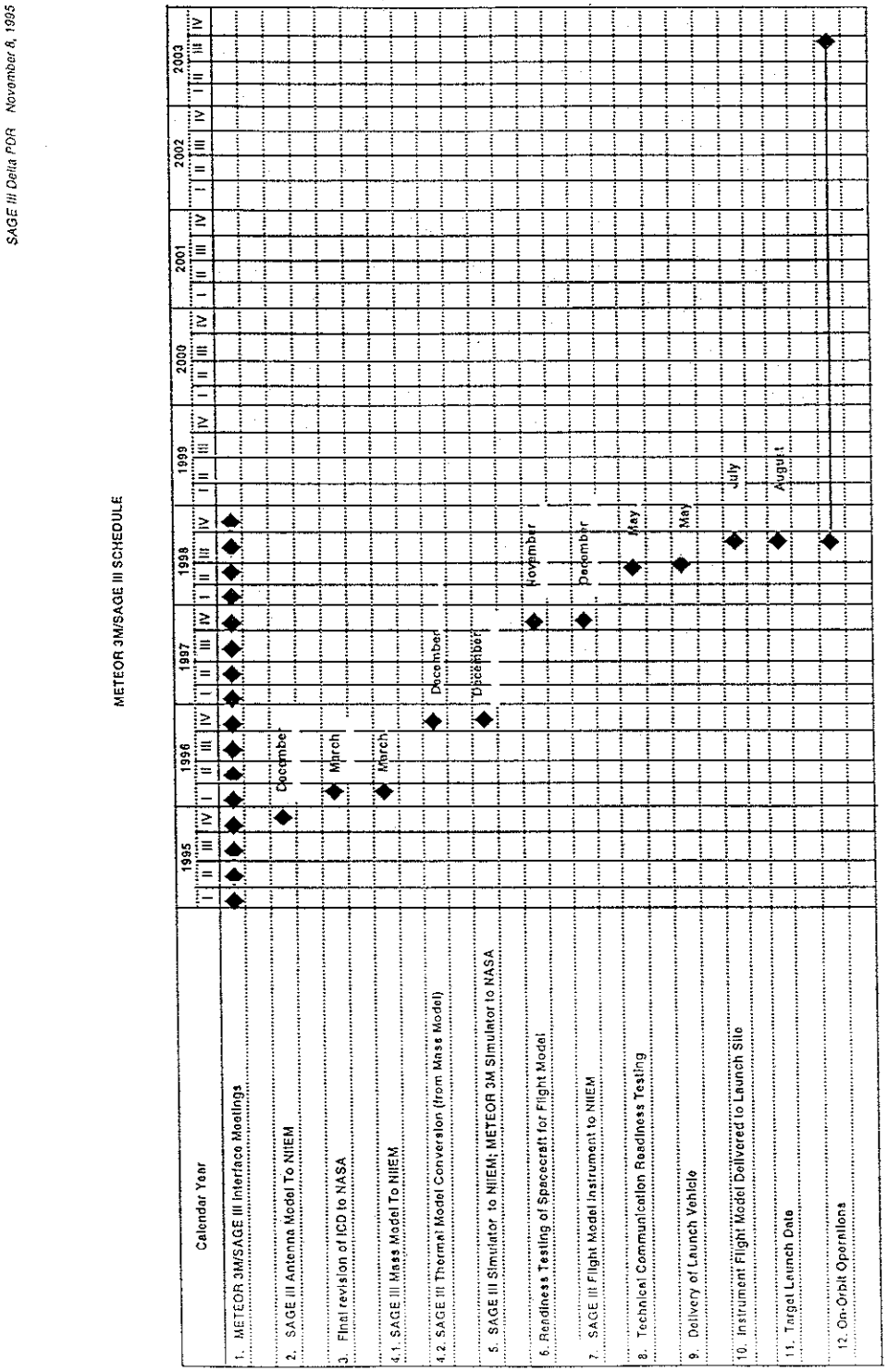
Support from the GSFC Flight Dynamics Facility (FDF) is also critical. The FDF is expected to support the development/validation of definitive orbit determination software algorithms compatible with GPS/GLONASS receiver data on-board the Meteor 3M spacecraft.

Summary

This overview of the Meteor 3M/SAGE III mission operation concept has been extracted from the SAGE III Mission Operations Concept and is not intended to be all inclusive. The SAGE III Mission Operations Concept document should be read for a more detailed description of SAGE III mission operations.

1. PAGE TITLE: Planned Mission Milestones		2. REPLACES	3. SECTION: 1140
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description Milestone schedule.



1. PAGE TITLE: Radio Frequency (RF) Telecommunications - Requirements		2. REPLACES	3. SECTION: 2000
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

The SAGE III RF communications support consists of downlink telemetry support during the normal on-orbit phase of the mission. The detailed RF and telemetry requirements are provided in sections 2005 and 2020.

1. PAGE TITLE: Radio Frequency (RF) Telecommunications - Summary Tables		2. REPLACES	3. SECTION: 2005
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

The SAGE III RF communications support will be provided through the Wallops Flight Facility (WFF). Spacecraft communications will consist of downlink telemetry only. The WFF shall support data relay from the Meteor 3M spacecraft twice a day to capture the 24 hours of SAGE III science and housekeeping telemetry data.

Frequency Utilization Summary

Link Frequency (MHz)	Item No.	Link Mode	Modulating Encoding Scheme	Data Rate (kb/sec)	Data Type	Purpose and Remarks
1704.3384	1	PM	Bi-phase L	665.4	Instrument Telemetry	SAGE III Recorded data

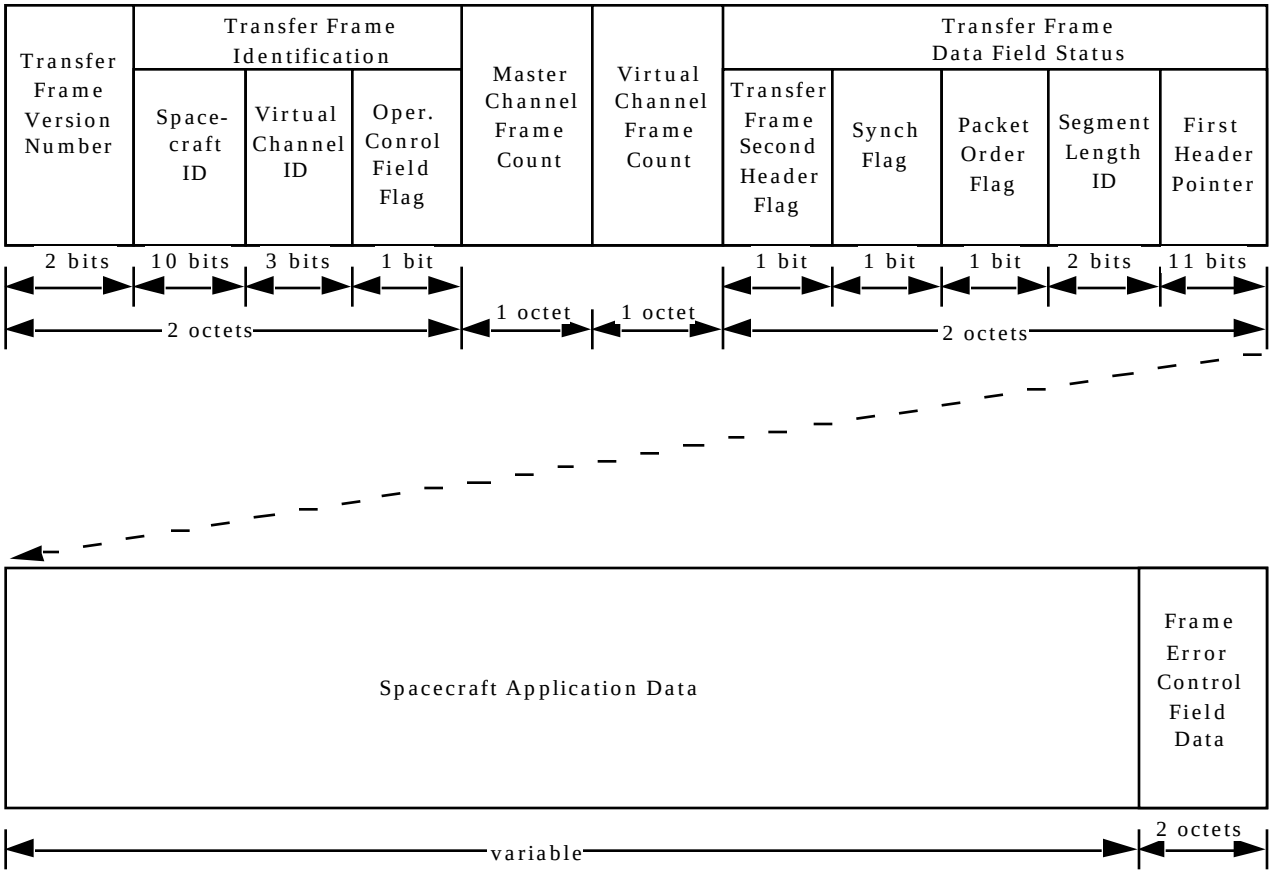
10. Response

Requirement will be met.

1. PAGE TITLE: Radio Frequency (RF) Telecommunications - Telemetry Frame Structure		2. REPLACES	3. SECTION: 2020
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

SAGE III will be using the CCSDS Transfer Frame structure for the telemetry data format. The Transfer Frame Format is shown below.



1. PAGE TITLE: Wallops Flight Facility (WFF) Requirements Summary		2. REPLACES	3. SECTION: 2400
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

WFF shall support two, twelve minute nominal contacts per day occurring approximately twelve (12) hours apart. Support is for downlink telemetry only. Each contact will consist of data played back from the LaRC recorder. WFF shall capture and forward the data to the LaRC. LaRC will provide schedule and acquisition data to WFF.

10. Response

Requirement will be met.

1. PAGE TITLE: Wallops Flight Facility (WFF) Requirements - Downlink		2. REPLACES	3. SECTION: 2420
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

WFF shall support the SAGE III downlink data acquisition as detailed in section 2005. The downlink telemetry is comprised of the SAGE III instrument playback data at 665.4 kb/sec. The downlink telemetry is a PM carrier at 1704.3384 MHz with Bi-phase L coding. Site acquisition data will be provided by LaRC.

WFF shall implement the following capabilities:

1. Interface to standard Internet Protocol
2. Data quality monitoring
3. Store and forward data to LaRC
4. Archive raw data for a minimum of 14 days.

10. Response

Requirement will be met.

1. PAGE TITLE: Testing and Training Requirements		2. REPLACES	3. SECTION: 3000
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

Data flows, operations exercises and simulations shall be conducted between WFF and LaRC. A SAGE III data simulator and/or electronic data files will be used as data source for interface tests at WFF.

Station compatibility testing shall be performed between the WFF station equipment and a Russian Engineering Test Unit (ETU). The ETU will be configured to emulate the actual spacecraft RF output. Actual recorded SAGE III telemetry or simulated telemetry will be provided to the ETU by LaRC.

10. Response

Requirement will be met.

1. PAGE TITLE: Compatibility Testing		2. REPLACES	3. SECTION: 3100
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

General

Compatibility testing is an assurance test of the RF link between the flight hardware and the ground station support equipment. Compatibility testing demonstrates that the ground station equipment and operating procedures are adequate to meet mission requirements.

Compatibility Test

A compatibility test shall be conducted on the WFF ground station equipment. The Russian Meteor 3M personnel will supply the ETU to simulate the spacecraft RF downlink. The output of the ETU will be connected to the test inject system of the WFF antenna. SAGE III simulated telemetry (or actual SAGE III recorded telemetry) will be provided to the ETU. The ETU will modulate the data and output the simulated downlink at RF. The simulated RF downlink will then be received, demodulated and processed by the WFF equipment. The ETU RF output level will be attenuated and the data will be monitored to determine the receive threshold of the ground station. Data from the testing will be sent to a file for comparison. The file will also be transferred using FTP to LaRC.

The final test configuration will be negotiated with the RSA and documented in the Joint Mission Operations Plan.

10. Response

Requirement will be met.

1. PAGE TITLE: Trajectory and Attitude Support Requirements Summary		2. REPLACES	3. SECTION: 7000
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

The Flight Dynamics Division shall provide trajectory support for the mission by providing pre-mission coordination, and also providing the SAGE III Project with software for orbit determination, orbit propagation, and acquisition data generation, as defined in Section 7200.

There are no attitude support requirements for the Flight Dynamics Division.

10. Response

Requirement will be met.

1. PAGE TITLE: Mission Requirements Request		2. REPLACES	3. SECTION: Appendix A
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.

9. Description

The Flight Dynamics Division shall provide the following support:

a. Development and installation of orbit determination (OD) and orbit propagation software on a Langley computing platform. The orbit determination software will process GPS/GLONASS state vectors, available in a text format on the platform, and perform a least squares orbit estimation to obtain a definitive solution accurate to at least: 500 meters along-track, 250 meters radial, and 1000 meters cross track.

b. On-orbit validation of GPS/GLONASS state vectors using an independent navigation system.

c. Development and installation of acquisition data generation software on the Langley computing platform. The acquisition data generation software will use an ephemeris, generated using the orbit propagation software on the Langley computing platform, to generate improved interrange vectors (IIRVs) to be transmitted electronically to the Wallops Island station for acquisition of the Meteor-3M/SAGE III satellite.

The following additional information is provided:

1) Output of the orbit determination software will be:

a. Predicted ephemeris file containing orbital state vectors at a specified frequency and specified duration.
b. Ground station predicted contact times.
c. Definitive ephemeris files containing orbital state vectors at a specified frequency during specified event times.
d. Quality assurance parameters from a batch, least-squares orbital estimation.

2) Configuration files and sample setups will be provided for nominal Meteor/SAGE III support. System automation does not need to be provided.

3) The software will be minimally benchmarked on the Langley platform (it may be developed and tested at FDD prior to porting it to the Langley platform).

4) The FDD development platform will be a HP 9000/715 running HP-UX. Execution of the FDD provided software on a different platform will require porting to be performed by the software user.

10. Response

Requirement will be met.

1. PAGE TITLE: Mission Requirements Request		2. REPLACES	3. SECTION: Appendix A
		DATED:	4. DATE April 24, 1996
5. PROJECT TITLE: SAGE	6. MISSION(S) Meteor-3M/SAGE III	7. PROGRAM NO.	8. REV. NO.